Dispersion Compensators based on SOI Photonic Crystals

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Dispersion compensators (DCs) are inevitable for long-range optical data transmission systems. Currently used DC systems with lengths of a few km or m such as dispersion compensating fibers or Fiber Bragg Gratings, respectively, are rather bulky devices. We designed a planar photonic crystal waveguide (PPC WG) with a bandstructure yielding a negative and almost linear dispersion of about 30 ps/nm/mm at 1.55 µm wavelength over a 40 GHz single-channel. This kind of device can be completely integrated into a planar optical circuit. Moreover, tuning of the material properties for fine adjustment after fabrication is possible. The design of this device is based on a W1 waveguide in a hexagonal array of air pores in the SiO_2/Si/SiO_2 material system. The study of both the bulk PPC and the WG properties required extensive simulations, combining the results by a plane-wave method and by a FDTD code. To improve the relatively poor coupling of light between incoming and outgoing ridge WGs and the PPC WG, we also developed a new taper concept, the W1.5 WG taper. Experimental realization was achieved using standard dry etching equipments by developing RIE/ICP etch processes using a Cr hard mask. With this approach PPC waveguides in pore arrays with pore diameters ~300 nm and depth ~ 1.5 µm have successfully been fabricated.